

## CLAIMS

What is claimed is:

- 1 1. A rubbed substrate structure for use in a liquid crystal assay device,  
2 comprising:
  - 3 (a) a biochemical blocking compound chemically immobilized on a support  
4 thereby forming a biochemical blocking layer; and
  - 5 (b) a biomolecule recognition agent deposited on the same side of the  
6 support as the biochemical blocking layer,
- 7 wherein a surface of the biochemical blocking layer is a rubbed surface that  
8 possesses features that drive a uniform anchoring of liquid crystals when the  
9 liquid crystals contact the rubbed surface,
- 10 wherein the biochemical blocking layer resists non-specific adsorption of non-  
11 target species, and
- 12 further wherein the biomolecule recognition agent comprises a recognition site  
13 capable of selectively recognizing a target species.
- 1 2. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the biomolecule recognition agent is deposited  
3 on the rubbed surface.
- 1 3. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the biomolecule recognition agent is deposited  
3 on the same side of the support as the biochemical blocking layer before the  
4 biochemical blocking layer is rubbed.
- 1 4. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the biochemical blocking compound is  
3 immobilized on the support by crosslinking with a crosslinking agent.

1 5. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 4, wherein the crosslinking agent is glutaraldehyde.

1 6. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the biochemical blocking compound is  
3 immobilized on the support by being bonded to a bifunctional spacer  
4 compound, wherein the bifunctional spacer compound is bonded to a surface  
5 modifying compound and the surface modifying compound is bonded to a  
6 functionality on the surface of the support.

1 7. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the biomolecule recognition agent is  
3 immobilized on the support by being bonded to a bifunctional spacer  
4 compound, wherein the bifunctional spacer compound is bonded to a surface  
5 modifying compound and the surface modifying compound is bonded to a  
6 functionality on the surface of the support.

1 8. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the biochemical blocking compound comprises  
3 a serum albumin and the biomolecule recognition agent is an immunoglobulin,  
4 a portion of an immunoglobulin, a peptide, a polypeptide, a carbohydrate, a  
5 fragment of RNA, or a fragment of DNA.

1 9. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the biochemical blocking compound comprises  
3 bovine serum albumin and the biomolecule recognition agent is capable of  
4 recognizing and binding peptides, polypeptides, DNA, RNA, DNA fragments,  
5 RNA fragments or a binding domain associated with a protein, a virus, a  
6 bacteria, or a microscopic pathogen.

- 1 10. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein at least two regions of the rubbed surface are  
3 rubbed under different pressures, speeds, or for different lengths whereby the  
4 at least two regions of the rubbed surface have different sensitivities towards  
5 the target species.
- 1 11. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the biochemical blocking layer is a serum  
3 albumin.
- 1 12. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 11, wherein the serum albumin is bovine serum albumin.
- 1 13. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 11, wherein the serum albumin is human serum albumin,  
3 rodent serum albumin, canine serum albumin, feline serum albumin, porcine  
4 serum albumin, equine serum albumin or rabbit serum albumin.
- 1 14. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the support comprises glass.
- 1 15. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the support comprises silica.
- 1 16. The rubbed substrate structure for use in a liquid crystal assay device  
2 according to claim 1, wherein the biomolecule recognition agent comprises a  
3 portion of an immunoglobulin, a peptide, a protein, a carbohydrate, a fragment  
4 of RNA or a fragment of DNA.

- 1 17. A kit for use in a liquid crystal assay, comprising:
  - 2 (a) at least one rubbed substrate structure according to claim 1;
  - 3 (b) a second surface that uniformly anchors liquid crystals;
  - 4 (c) a spacing material adapted to be placed between the rubbed substrate
  - 5 and the second surface that uniformly anchors liquid crystals; and
  - 6 (d) a liquid crystal compound.
- 1 18. The kit for use in a liquid crystal assay according to claim 17, wherein
- 2 the liquid crystal is 4-cyano-4'-pentylbiphenyl.
- 1 19. The kit for use in a liquid crystal assay according to claim 17, wherein
- 2 the at least one rubbed substrate structure, the second surface that uniformly
- 3 anchors liquid crystals, and the spacing material are preassembled into an
- 4 optical cell.
- 1 20. A kit for use in detecting the presence of a target species in a sample,
- 2 the kit comprising: at least one rubbed substrate structure according to claim
- 3 1 and a liquid crystal compound.